

A survey on generative adversarial networks for imbalance problems in computer vision tasks

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Abstract

Any computer vision application development starts off by acquiring images and data, then preprocessing and pattern recognition steps to perform a task. When the acquired images are highly imbalanced and not adequate, the desired task may not be achievable. Unfortunately, the occurrence of imbalance problems in acquired image datasets in certain complex real-world problems such as anomaly detection, emotion recognition, medical image analysis, fraud detection, metallic surface defect detection, disaster prediction, etc., are inevitable. The performance of computer vision algorithms can significantly deteriorate when the training dataset is imbalanced. In recent years, Generative Adversarial Neural Networks (GANs) have gained immense attention by researchers across a variety of application domains due to their capability to model complex real-world image data. It is particularly important that GANs can not only be used to generate synthetic images, but also its fascinating adversarial learning idea showed good potential in restoring balance in imbalanced datasets. In this paper, we examine the most recent developments of GANs based techniques for addressing imbalance problems in image data. The real-world challenges and implementations of synthetic image generation based on GANs are extensively covered in this survey. Our survey first introduces various imbalance problems in computer vision tasks and its existing solutions, and then examines key concepts such as deep generative image models and GANs. After that, we propose a taxonomy to summarize GANs based techniques for addressing imbalance problems in computer vision tasks into three major categories: 1. Image level imbalances in classification, 2. object level imbalances in object detection and 3. pixel level imbalances in segmentation tasks. We elaborate the imbalance problems of each group, and provide GANs based solutions in each group. Readers will understand how GANs based techniques can handle the problem of imbalances and boost performance of the computer vision algorithms.